



Lesson Plan: Mirrors and lenses

Grade Level: 8

Subject: Physical Science

Duration: 45–60 min

NGSS MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Learning Objectives

By the end of this lesson, students will be able to:

- **Describe** how light bounces back in an orderly way off a smooth mirror but scatters off a rough surface.
- **Explain** how a convex lens bends light rays together to a focal point while a concave lens



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the surface itself instead of a mirror image.

- **Refraction:** The bending of light that happens when light passes at an angle from one clear material into another, such as from air into water or glass. Materials that slow light more, like glass and diamond, bend it more.
- **Convex lens:** A lens that is thicker in the middle than at its edges. It bends light rays together so they meet, which makes objects look larger and lets the lens project an image onto a screen.
- **Concave lens:** A lens that is thinner in the middle than at its edges. It spreads light rays apart so they never meet, which makes objects look smaller and upright.



- **Focal point:** The spot where light rays come together after being reflected by a curved mirror or bent through a lens. Rays from a concave lens spread out instead, so they never reach a focal point.
- **Virtual image:** An image that only appears to be there because the light rays never actually meet. It looks upright and seems to sit behind the mirror or lens, and it cannot be caught on a screen. The image you see in a flat mirror is virtual, with its left and right sides swapped.
- **Real image:** An image formed where light rays truly cross after reflecting off a curved mirror or passing through a convex lens. It appears upside down, can be smaller or larger than the object, and can be caught on a screen or on the back of your eye.

 **Materials Needed:** (all links are included in this PDF)

- Mirrors and Lenses Study Guide (<https://newpathworksheets.com/api/guide/study-guide-science-grade-8-mirrors-and-lenses.pdf>)



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- White index cards used as screens to catch the real image a convex lens projects

Lesson Procedure

Step 1: Introduction (8 minutes)

- Ask students: why does your reflection in a flat bathroom mirror stand upright, while your reflection in the bowl of a shiny spoon is upside down?



- Have pairs hold a plane mirror, raise their right hand, and describe which hand the image raises, establishing that a flat mirror swaps left and right.
- Stand a straight straw in a clear cup of water and have students sketch what they see, then hold the question of why the straw looks broken at the water line until refraction is introduced.

Step 2: Direct Instruction (15 minutes)

- Use the Study Guide to contrast the orderly reflection off a smooth mirror with the diffuse reflection off a rough surface, and explain why only the smooth surface returns a recognizable image. (<https://newpathworksheets.com/api/guide/study-guide-science-grade-8-mirrors-and-lenses.pdf>)
- Darken the room and shine a narrow-beam flashlight through a handheld magnifying glass onto a white index card so students watch the rays converge at a focal point, then repeat with a concave lens so they see the rays spread apart and never meet.
- Using the Study Guide ray diagrams, establish the rules students will apply all lesson: a plane mirror always makes a virtual image, a concave mirror makes a real or a virtual image,



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- Have pairs sort a plane mirror, a spoon, a magnifying glass, and a pair of eyeglasses into a reflects-light pile and a refracts-light pile, and defend each placement out loud.

Step 4: Independent Practice (12 minutes)

- Have students complete Practice Worksheet 1 on their own, including the concave-mirror diagram items that ask them to label the focal point, the object, and the image. (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-8-mirrors-and-lenses-1.pdf>)



- Ask students to slide a magnifying glass slowly away from a printed word and record the exact distance at which the letters flip upside down, then name the image on each side of that point as virtual or real.
- Have students read the index-of-refraction table on Practice Worksheet 1 and rank air, water, crown glass, and diamond by how strongly each bends light.
(<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-8-mirrors-and-lenses-1.pdf>)

Step 5: Assessment (8 minutes)

- Administer Practice Worksheet 2 as the end-of-lesson check; it covers where an image should focus inside the eye, which lens corrects nearsighted vision, and the images made by plane and concave mirrors. (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-8-mirrors-and-lenses-2.pdf>)
- Have students classify a bathroom mirror, a store security mirror, a magnifying glass, and a pair of nearsighted eyeglasses by whether it reflects or refracts light and whether the image it makes is real or virtual.



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- Give students a pre-labeled ray-diagram card showing a convex lens with the object, focal point, and real image already marked, so they can match it against the unlabeled diagrams on Practice Worksheet 1.
- Let students keep a polished spoon at their desk and flip between the concave and convex sides while naming the image each side produces.

Extension Activities



- Build a pinhole camera from a lightproof box and compare its upside-down image with the real image a magnifying glass projects onto an index card.
- Shine a laser pointer into one end of a water-filled clear plastic tube and watch the light stay trapped along the bend, modeling how an optical fiber carries light over long distances.
- Measure the focal length of a magnifying glass, a pair of reading glasses, and a clear water-filled bottle by focusing a distant lamp onto an index card, then rank them from shortest to longest.



Complete List of Available Resources:

- NewPathWorksheets: Mirrors and lenses (<https://newpathworksheets.com/science/grade-8/mirrors-and-lenses>)
- Study Guide PDF (<https://newpathworksheets.com/api/guide/study-guide-science-grade-8-mirrors-and-lenses.pdf>)



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MIRRORS AND LENSES

Overview

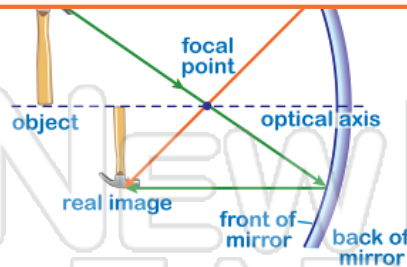
The **reflection** of light can occur in different ways.

Since a mirror has a very smooth surface, all the light bouncing off of a mirror reflects in a **regular** manner. In a plane or flat smooth mirror, the image that forms is **virtual** which means it doesn't really exist. In the picture below, while the image is the same size as the object and is upright like the object, its left and right sides are reversed and it seems to be behind the mirror.



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LESSON CHECKPOINT: What kinds of images form off of a concave mirror?

Light Refraction

Refraction or the bending of light occurs when light enters at an angle through a different medium



The refraction of light through a lens can have much different results



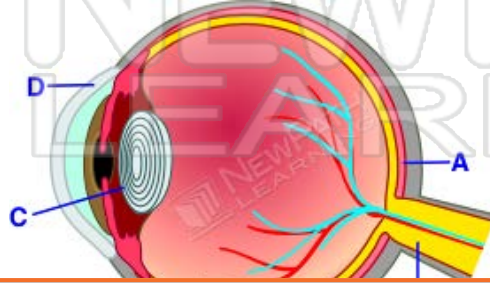
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With the concave lens, the light rays get spread out and never form a focal point. The result of this is that **convex lenses** can form either real or virtual images depending on how far the object is from the lens. On the other hand, since light rays passing through a **concave lens** never meet, the image formed is always virtual.

Human Vision

Without our eyes and brain, vision would not be possible. The eye, shown below, takes in light through the small opening in the eye called the **pupil**. The light then goes through a convex lens (C) where it is focused exactly on the **retina** (A). Here, many sensitive nerve endings take the focused light image and convert it to a nerve message (B) which goes to the vision center in the brain. The brain interprets this nerve impulse as a vision.



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wavelength to create precise beams that can be used to measure, to cut material, or even as a surgical tool.

- **Optical fibers** are thin strands of glass that carry confined laser beams. Because these fibers can carry the laser over very long distances they are extremely useful in communications technologies. Many homes have fiber optic service that brings in internet websites and television pictures. These fibers are also used to look inside our bodies. These fibers are so thin, doctors do not have to make large incisions in order to see inside the human body.



Name _____ Class _____ Date _____

1 What is the kind of light being produced by a **laser pointer**?

- A incoherent
- B bright
- C diffused
- D coherent



2 All the light produced by the device below has the **same wavelength**. This device is called a _____.

- A beam
- B ray
- C laser
- D flashlight



3 What is the difference between a **mirror** and a **lens**?

- A a mirror reflects light and a lens refracts light
- B a lens and a mirror both reflect light



4 What is the difference between **reflection** and **refraction**?

- A with reflection, light rays bend; with refraction, light bounces back
- B with refraction, light rays bend; with reflection, light bounces back
- C reflection is can occur, but



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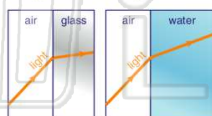
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- D neither a lens, nor a mirror



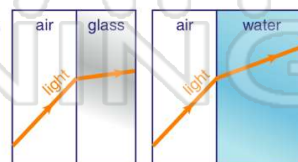
9 In the diagram below, light is **passing through** three different materials. What is **happening** to the **light** as it goes through these materials?

- A it is being reflected
- B it is being deflected
- C it is being refracted
- D it is being diffused



10 In the diagram below, which of the substances **refracts** light the **most**?

- A moisture
- B air
- C water
- D glass





Name _____ Class _____ Date _____

1 What is the kind of light being produced by a **laser pointer**?

- A incoherent
- B bright
- C diffused
- D coherent



D

2 All the light produced by the device below has the **same wavelength**. This device is called a _____.

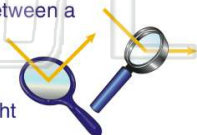
- A beam
- B ray
- C laser
- D flashlight



C

3 What is the difference between a **mirror** and a **lens**?

- A a mirror reflects light and a lens refracts light
- B a lens and a mirror both reflect light



A

4 What is the difference between **reflection** and **refraction**?

- A with reflection, light rays bend; with refraction, light bounces back
- B with refraction, light rays bend; with reflection, light bounces back
- C reflection is can occur, but

B

5



A

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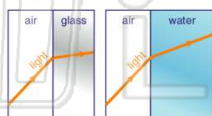
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C

9

In the diagram below, light is **passing through** three different materials. What is **happening** to the **light** as it goes through these materials?

- A it is being reflected
- B it is being deflected
- C it is being refracted
- D it is being diffused

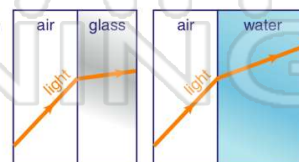


C

10

In the diagram below, which of the substances **refracts** light the **most**?

- A moisture
- B air
- C water
- D glass



D

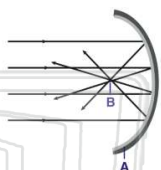


Name _____ Class _____ Date _____

1

In the diagram below, light is reflecting off a mirror back through a focal point. Label A is pointing to what **kind of mirror**?

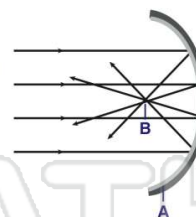
- A deflecting
- B reflecting
- C concave
- D convex



2

In the diagram below, **label B** is at what point?

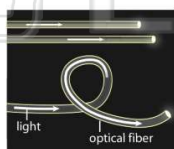
- A electromagnetic point
- B object point
- C focal point
- D optic point



3

An **optical fiber** is a _____.

- A thin tube of copper that conducts a light beam
- B thin tube of glass that conducts a laser



4

Optical fibers can be used to see **inside the human body** through a long tube. As a result, they are used for _____.

- A studying fingernails
- B looking at bacteria
- C performing surgery



5



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- C mirage
- D thought



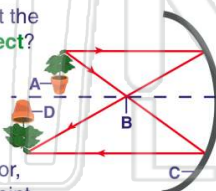
- D optical point



9

Which statement about the diagram below is **correct**?

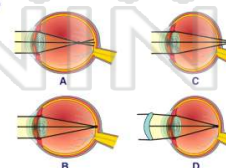
- A C is a convex mirror, and B is the focal point
- B C is a concave mirror, and B is the focal point
- C B is the focal point, and A is the image
- D C is a concave mirror, and D is the object



10

The diagrams below show light passing through a human eye. In which of the diagrams is the focal point **behind** the **retina**?

- A A
- B B
- C C
- D D

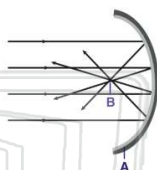




Name _____ Class _____ Date _____

- 1 In the diagram below, light is reflecting off a mirror back through a focal point. Label A is pointing to what **kind of mirror**?

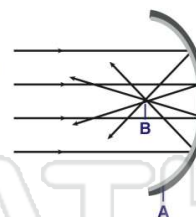
A deflecting
B reflecting
C concave
D convex



C

- 2 In the diagram below, label B is at what point?

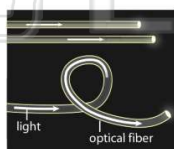
A electromagnetic point
B object point
C focal point
D optic point



C

- 3 An **optical fiber** is a _____.

A thin tube of copper that conducts a light beam
B thin tube of glass that conducts a laser



B

- 4 **Optical fibers** can be used to see **inside the human body** through a long tube. As a result, they are used for _____.

A studying fingernails
B looking at bacteria
C performing surgery



C

5



A

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A

C mirage
D thought

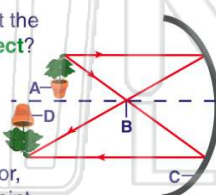


D optical point



- 9 Which statement about the diagram below is **correct**?

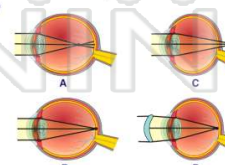
A C is a convex mirror, and B is the focal point
B C is a concave mirror, and B is the focal point
C B is the focal point, and A is the image
D C is a concave mirror, and D is the object



B

- 10 The diagrams below show light passing through a human eye. In which of the diagrams is the focal point **behind** the **retina**?

A A
B B
C C
D D



C

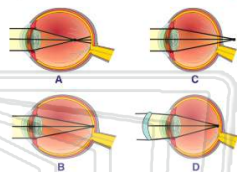


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1

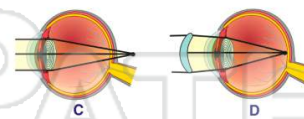
The diagrams below shows light passing through a human eye. Which shows an eye of a person who is **nearsighted**?

- A A
- B B
- C C
- D D

**2**

The best way to **correct** the vision problem with the eye labeled **C** is to use a **corrective** contact lens such as in diagram **D**. That is a _____ lens.

- A concave
- B convex
- C round
- D plane

**3**

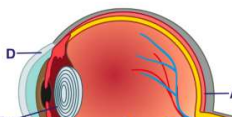
When **standing outside** of a **swimming pool** and looking in, a swimmer saw an object on the bottom. What explains why she **saw the object from above**, but when she dove in, **had a hard time finding it**?

- A pool water reflects light

4

In the diagram of the eye, an **image** is supposed to **focus** at point _____.

- A A
- B B
- C C
- D D

**5**

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D film

pinhole camera

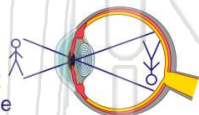
D electromagnetic

light optical fiber

9

When looking into a **concave** mirror, a **real** **image** is _____.

- A an upright image where light rays meet
- B an upside-down image where light rays meet
- C an upside-down image where light rays appear to meet
- D an upright image where light rays appear to meet

**10**

When a person looks in a **plane** mirror, he sees _____.

- A a real image of himself
- B an enlarged image of himself
- C a virtual image of himself
- D a mirage of himself

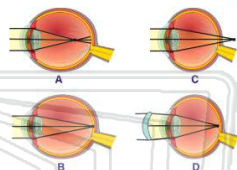


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1

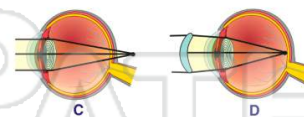
The diagrams below shows light passing through a human eye. Which shows an eye of a person who is **nearsighted**?

- A A
- B B
- C C
- D D

**A****2**

The best way to **correct** the vision problem with the eye labeled **C** is to use a **corrective** contact lens such as in diagram **D**. That is a _____ lens.

- A concave
- B convex
- C round
- D plane

**B****3**

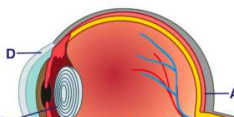
When **standing outside** of a **swimming pool** and looking in, a swimmer saw an object on the bottom. What explains why she **saw the object from above**, but when she dove in, **had a hard time finding it**?

- A pool water reflects light

B**4**

In the diagram of the eye, an **image** is supposed to **focus** at point _____.

- A A
- B B
- C C
- D D

**A****5****C**

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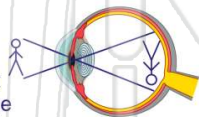
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D**9**

When looking into a **concave** mirror, a **real** **image** is _____.

- A an upright image where light rays meet
- B an upside-down image where light rays meet
- C an upside-down image where light rays appear to meet
- D an upright image where light rays appear to meet

**B****10**

When a person looks in a **plane** mirror, he sees _____.

- A a real image of himself
- B an enlarged image of himself
- C a virtual image of himself
- D a mirage of himself

C



Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Optic nerve

Concave lens

Focal point

Diffuse reflection

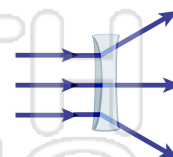
Lens

Mirage

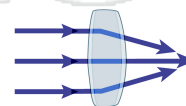
Optical fiber

Convex lens

1. - type of lens which is thinner in the middle than on its edges and makes things look smaller



2. - a lens that is thicker in the middle than on its edges and makes things look larger



3. rough



4. refrac

5. also a

6. refrac

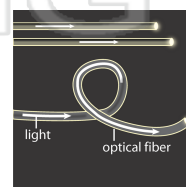
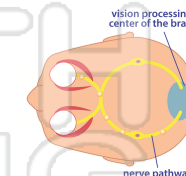
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7. - the nerve that carries the image of an object from the retina to the brain



8. - long, thin strands of glass or plastic that can carry light for long distances without allowing any light to escape





Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Optic nerve

Concave lens

Focal point

Diffuse reflection

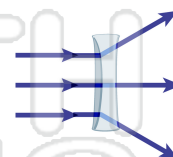
Lens

Mirage

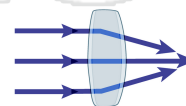
Optical fiber

Convex lens

1. concave lens - type of lens which is thinner in the middle than on its edges and makes things look smaller



2. convex lens - a lens that is thicker in the middle than on its edges and makes things look larger



3. diff
rough

4. foc
throug

5. len
glass v

6. mir



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7. optic nerve - the nerve that carries the image of an object from the retina to the brain



8. optical fiber - long, thin strands of glass or plastic that can carry light for long distances without allowing any light to escape

